

them Arizona is but a bridge to reach their breeding and winter grounds, hence they are met with here only as travelers to the north and south. Among the summer residents I cannot say there was any appreciable diminution, but it did noticeably change the nesting habits of several of the larger Thrashers. Heretofore they had chiefly made homes in the different forms of cacti, and when this was broken down and destroyed they occupied the next round on the vegetable ladder—mesquite and palo verde trees and bushes.

THE MOULT OF THE NORTH AMERICAN *TETRAONIDÆ* (QUAILS, PARTRIDGES AND GROUSE).

BY JONATHAN DWIGHT, JR., M. D.

I. Fundamental Principles of Mould and of Plumage.

IN SPITE of all that has been written regarding the plumages of the Grouse and their allies variously known as the Quails, Partridges, Pheasants and Ptarmigans, there still is room for further discussion of the relations that exist between their plumages and their moults, from which standpoint little has hitherto been attempted. From the comparative study of moult in other groups of birds, I am convinced that this is the proper point from which to view the subject in order to comprehend its full significance.

The fact that the plumage of any bird at a given time is simply one of a series following each other during the bird's natural life, is obvious when it is remembered that each new feather grows from the same papilla as the old one. Plumage, which is an assemblage of feathers, would be very simple to understand if all the papillæ were equally active at a period of moult, but as a matter of fact, individual papillæ, as well as whole groups of them, may remain dormant and thus produce the mixed plumages that have been so difficult to understand in many species of birds.

As some feathers, chiefly in young birds, may survive several periods of moult without being renewed, it follows that a recognized stage of plumage may consist of feathers developed at no less than two or three separate periods, and besides this the plumage will be modified by the wear and tear to which it has been exposed. That there is a definite sequence of plumages and of moults is a fundamental fact of the greatest importance and goes far to explain problems of plumage which may be found either among the Grouse or among distantly related birds.

The exact method of moulting in the Tetraonidæ has been understood none too well, and there are some details the significance of which has been quite overlooked. There are nearly forty species and subspecies of these birds distributed among ten genera accredited to North America, and although there is great diversity in relative size and in the patterns and colors of their plumage, they differ little in their moults, which conform quite closely to those of other birds. In an article now in press (*Annals N. Y. Acad. Sci.*, XIII, 1900, pp. 1—, pll. i—vii.), I have shown in considerable detail how the moult of Passerine species is effected, new feathers first appearing at definite central points in the different feather tracts or pterylæ. The growth of new feathers spreads so that outer rows and extremities of tracts are normally last to be renewed. This systematic replacement, which proceeds so gradually that birds are usually not deprived of power of flight nor of protective feathering, is also apparent in the Grouse and Quails, due allowance being made for differences of pterylosis. These differences have been so exhaustively treated in a recent paper by Mr. Hubert M. Clark (*Proc. U. S. Nat. Mus.*, XXI, 1898, pp. 641—653, pll. xlvii—xlix) that I need say nothing more upon the subject except later on to designate briefly the points at which new growth begins and the areas over which it spreads at different periods of moult.

In my earlier study of Passerine species, extending over a number of years, I reached conclusions that have enabled me to formulate some fundamental principles governing plumage and moult which my later study of the Tetraonidæ and other groups bears out in every particular. As the application of these principles will explain every plumage and every moult, I present them here before going farther. They are as follows:—

- I. Every species has a definite sequence of plumages and of moults.
- II. Moults are periodical systematic feather growths.
- III. Moults are complete or incomplete.
- IV. Plumage is renewed by moult.
- V. Plumage is modified by wear.

A word has already been said about each species having a definite series of plumages and of moults. This is found to be true of every species of Grouse and every species of Quail, plumage being renewed by feather-growth at definite periods while between them it is subjected to all the destructive influences of abrasion and fading which I have summed up under the word wear. It has been possible for me to reach these conclusions by an examination of the large series of Tetraonidæ in the American Museum of Natural History, thanks to the kindness of the Curator of Zoölogy, Dr. J. A. Allen, who has afforded me every facility. I must confess that the study of moult from museum skins presents many difficulties. The loss of feathers from the birds when fresh and the crowding together of parts of the skin, especially of the wings, obliterates many details or renders their demonstration impossible without serious mutilation of the specimens when once dried. Fortunately a few specimens of *Colinus*, *Dendragapus* and *Bonasa* in my own collection were studied before they were skinned so that I am able in a measure to make up the serious shortcomings of dried skins.

Before taking up the Grouse and Quails individually it will be well first to consider their moults in general and then discuss their plumages, the same fundamental principles being applicable to all of them.

Among the Tetraonidæ two distinct periods of moult may be recognized in adults and two others in young birds occurring shortly after they leave the nest. The one which occurs in adults at the end of the breeding season is complete, just as it is in all species of North American birds, and is known as the Postnuptial Moult; the other, which is seldom complete in any species and in the Tetraonidæ chiefly confined to a very limited area of the head and throat, is known as the Prenuptial Moult. In the Quails the prenuptial moult includes very little beyond the sides of the head

and the black, white or brown chin area, as the case may be, while in females the renewal is still more restricted or even suppressed. In the Grouse, I can find little satisfactory evidence of prenuptial moult beyond the growth of a few feathers about the chin, except in *Lagopus*, which has the most extensive renewal of any of the Quails or the Grouse. It is extremely easy to overlook an incomplete and restricted prenuptial moult, for all members of the family being game-birds, they are protected by law during most of the year and very few specimens taken at or just after this period of moult have found their way into collections. There is, however, unquestionable evidence, that this moult takes place in several species during April and May, and probably it is characteristic of all of them.

Lagopus alone is peculiar in having an extra or supplementary postnuptial moult. The conditions of life under which this Arctic bird lives perhaps necessitates this extra moult, which is not, however, confined to this genus but appears to be a regular feature in the moult of certain Anatidæ. It is a true moult involving the brown or dusky portion of the plumage already wholly renewed by the regular and complete postnuptial. It will be discussed more fully later.

Adults, then, have two periods of moult in most if not all of the species, while young birds also have two periods of moult, one when they doff the downy plumage in which they leave the egg, the Postnatal Moult, the other when they assume winter plumage, the Postjuvénal Moult. All species of Grouse and Quails at the latter moult assume a plumage scarcely distinguishable from that of the adult. This is true in a large measure even of *Lagopus* but here again we find an extra moult supplementary to the postjuvénal, and, as in the adult, limited in extent.

In speaking of moult the idea of periodicity must be borne in mind. New growth which occurs at any time when one or more feathers are torn out is simply an accident. At every period of moult feather growth begins at definite points and spreads systematically from them. This is what always happens at any one of the series of moults peculiar to each species. If the moult be incomplete, the new growth ceases before it has spread to its usual limits, and very often stray feathers in its path are left over

until another period. There are all degrees of suppression in the extent of the areas involved by a moult which is partial, like the prenuptial, and females always renew more limited areas than do the males. The postnuptial moult seldom leaves a trace of the old plumage, nor as a rule do the complete moults of young birds of any species to whatever family they may belong.

A table that I prepared to show the relations existing between plumages and moults among Passerine species is with slight modification applicable to the Grouse and Quails. It is as follows:

<i>Plumages.</i>	<i>Moults.</i>
1. Natal	Postnatal
2. Juvenal	Postjuvenal
3. First Winter	First Prenuptial
4. First Nuptial	First Postnuptial
5. Second Winter (adult)	Second Prenuptial (adult)
6. Second Nuptial (adult)	Second Postnuptial (adult)
etc., etc.,	etc., etc.

This scheme distinguishes a series of plumages followed by moults which may be complete, partial, or even suppressed according to species, age, sex and individual. It permits of a plumage being called adult whenever evidences of immaturity are lost, and it is applicable to the Tetraonidæ by recognizing, in the exceptional case of *Lagopus*, the supplementary postjuvenal and postnuptial moults which produce the white supplementary winter plumage. In all the other Grouse and their allies the scheme is without exception, save the probability that the prenuptial moult is suppressed in some of them. More material must be examined to determine this, for as the feathers of these birds suffer comparatively little wear, owing to their structure, it is easy to overlook a prenuptial moult limited to a few feathers about the head.

A better understanding of the development of the different plumages at the periods of moult will be gained by taking each up in the order in which it appears:—

1. *Natal Down.*—The early history of this first stage of plumage must be sought within the egg, but we need only begin at the time when the chick emerges from the shell. The young of all the Tetraonidæ are densely covered at this stage with a downy plumage. Upon the individual feathers of this down,

which among other birds varies in structure according to family, several names have been bestowed, one of the latest being neosoptile, in contradistinction to teleoptile, the name applicable to every later feather (see Gadow, *Newton's Dictionary of Birds*, 1893, p. 243), although Mr. Wm. Palmer proposes the name mesoptile for the first feather which succeeds to the neosoptile. (See *Fur Seals and Fur Seal Islands of the North Pacific Ocean*, 1899, part III, p. 424.) The structure of the natal down resembles that of the barbs or rami of the succeeding feathers with which its filaments are continuous, being gathered into bundles at the apices of the new feathers. All the Grouse and Quails at this stage are very similar, being everywhere yellowish or grayish and immaculate below, and mottled on the back and head with various shades of chestnut and black, with a dusky mark behind the eye. There is a sort of a ruff on the nape, and in species which later have a crest, a tuft of longer down may mark the spot where it will appear. The chicks run about almost as soon as they are hatched, and within a few days begin to show signs of the succeeding plumage, which is rapidly assumed by a complete post-natal moult. It is of the utmost importance to follow the development of this second plumage, to which I have given the name juvenal.

2. *Juvenal Plumage.*—The first signs of this second stage (the feathers of which have been called mesoptiles and differ in structure from the teleoptiles of adults) will be found near the middle of each wing, where the remiges and their coverts appear extending in both directions from the carpus so that the distal and the proximal members of the series are latest in their development. It is well to notice here that in all subsequent moults involving the wings the progress of the moult corresponds approximately in matter of time to the order of development here indicated. The first tract to show any moult is usually the alar, beginning with the proximal primary (always the tenth among the Grouse and Quails), the moult proceeding distally, until about four primaries have fallen out when it proceeds proximally towards the body. The Tetraonidæ have one striking characteristic that seems to have been generally overlooked. The two distal primaries do not develop until the rest of the series of remiges (except the

innermost secondaries) is well developed, and their growth is so slow that the primary adjacent (the third) is often free of the persistent scale-like sheath, the remains of its follicle, before the quills of these two feathers have lost their pulpy look. In consequence of this, the postjuvinal moult, beginning with the loss of the tenth primary often before they are grown, reaches them in some cases before they have lost their signs of immaturity. They are not moulted, but retained for a twelvemonth, while the rest of the remiges are renewed by the postjuvinal moult. The distal pairs of primaries therefore belong to the juvenal plumage, while the rest are truly a part of the first winter dress. This peculiarity is not at all striking among the brown-quilled species, but in *Lagopus* it has doubtless occasioned some of the misunderstandings that have prevailed regarding the moult of the Ptarmigans. In these birds the two distal primaries are white when first developed, while the rest of the remiges are brown until renewed by white ones at the postjuvinal moult.

The next point at which new feather growth begins in the chick is on either side of the breast, spreading backwards along the sides, and a little later new feathers appear on the back at the root of the neck, upon the middle of the crown, and at the middle part of the humeral and femoral tracts. The tendency is to spread backwards with new points of departure anteriorly on the forehead, throat, chin and sides of the head, and posteriorly on the rump, flanks and abdomen. The wing-coverts reach their full development in advance of the remiges and before the body plumage, the greater and lesser in advance of the median, and the upper coverts before the lower. The chin and throat, sides of the head, neck, mid-abdomen and tarsi are late in losing the downy plumage and the rectrices are also late in their development. The same relative order of renewal is observable in later moults, plumage being renewed in very nearly the same order in which it originally grew. Renewal is very systematic in birds and if certain feathers of a tract or of a series have already been moulted, it is not difficult to predict when and where the next feather will have its place taken by a new one, provided the laws which govern moult, the distribution of the feather tracts and the peculiarities of species under consideration are known.

It is almost impossible to assign a time for the acquisition of the juvenal plumage. Birds about one third grown will still have downy chins, foreheads and abdomen and the tail barely showing, while the plumage elsewhere is well developed, except the opposite ends of the row of remiges, where the quills are only partly grown. At about this time, the first signs of the postjuvenal moult may be found in the replacement of the tenth primary by a new one, the first of the winter plumage. This moult may involve five or six primaries before it is noticeable upon the body at either side of the breast. Birds are about one half grown when this point of development is reached, perhaps three weeks or so old.

The tendency is for the juvenal plumage to resemble somewhat that of the adult female, the sexes, as a rule, not being certainly distinguishable, both wearing, for instance in the crested species, a crest that is usually brown, which in the adult would be black. All colors are apt to be duller than those of the next plumage, more uniformly colored, sometimes slightly barred or mottled feathers preceding the rich tints of the winter dress, which is practically alike in the young and old of nearly all species.

3. *First Winter Plumage.*—This third stage is reached by a postjuvenal moult which is complete except for the retention of the two distal primaries of each wing, and the plumage assumed is scarcely to be distinguished in any of the species from that of the adults in winter plumage. The completeness of the postjuvenal moult and the early acquisition of adult plumage simplifies all questions of plumage except in the Ptarmigans. They, however, assume a dress which is white except upon the head, throat, outer part of the sides and the back. The supplementary postjuvenal moult peculiar to them follows quickly and involves only the feathers of the dark areas. As the postjuvenal itself is scarcely complete before the supplementary one begins, it is not surprising that a plumage made up of feathers of three different periods of growth should have given rise to much discussion in explanation of the phases of dress through which these birds pass, there being a preliminary and a supplementary stage of the winter plumage. The difficulty is to draw the line between the different stages of plumage which, especially in the young bird, almost insensibly blend one into the other.

Any autumn bird that shows remains of the follicles about the two distal primaries and one or two mature feathers intervening between them and newly developed primaries further on in the series may always be set down as a young bird. In the adult the moult proceeds uniformly from the tenth to the first, so that if the two distal show immaturity and the remainder are all fully grown, the bird may be set down as an adult. This is true of all the Quails and all the Grouse.

The first winter plumage assumed, according to species, during September, October and November, is worn until the following April or May and in the case of the Ptarmigans of northern latitudes even into June, when either a prenuptial moult of limited extent takes place or a bird may be said to have passed into first nuptial plumage without moult, and by wear alone.

4. *First Nuptial Plumage.*—This is a fourth stage which is chiefly the first winter plumage plus an inconspicuous amount of wear, but a limited prenuptial moult renews a small part of the old plumage. The Quails and Grouse, most of them, assume new feathers limited to the throat patch of white, black or buff, which come in of very nearly the same color and pattern as the old, and to the sides of the head and forehead. The Ptarmigans assume dark feathers over larger areas, only the wings, tail, abdomen and flanks remaining white, but the individual variation is considerable.

This dress is commonly known as the breeding plumage. Just as soon as a pair of birds have started their brood in life, they undergo the first postnuptial moult, the male beginning the process in advance of the female. The Arctic Ptarmigans may begin early in July, the Grouse and the Quails usually in August or perhaps September, in some cases. This moult is invariably complete with the possible exception of a few feathers, and the slight differences between old and young which may have persisted up to this period are now practically obliterated and all subsequent plumages may be called adult. The year old Ptarmigans, like the birds of the previous autumn, assume a plumage reddish or dusky over the superior and anterior regions of the body, and a supplementary first postnuptial moult takes place by which the dark areas are renewed by white.

5. *Second or Adult Winter Plumage.*—As I have just pointed

out, this fifth stage is reached through the first postnuptial moult, the Ptarmigans alone assuming a supplementary winter dress by an extra moult of limited extent. Differences of plumage between young and old now wholly vanish, except that at later moults, with age, colors are supposed to deepen, but the actual age of a bird becomes a matter of conjecture. Birds in this dress can be told from birds of the year by osteological and histological characters, but there is often nothing characteristic in their plumage.

6. *Second or Adult Nuptial Plumage.*— Like the first nuptial this plumage may be only that of the winter plus wear (as it is in many females) or it may be partly renewed by an incomplete prenuptial moult confined to insignificant areas about the head, or, in the case of the Ptarmigans, extending over larger areas. It may be distinguished from the first nuptial in a very few cases only and passes into that of the third winter by a complete postnuptial moult.

So it is that plumages and moults will follow each other during the lifetime of a bird and a full comprehension of the systematic and harmonious workings of natural fundamental laws will go far towards dispelling the hazy ideas that have prevailed regarding both plumage and moult.

II. *Moult of the Individual Species.*

Colinus virginianus (Linn.). BOB-WHITE.

Natal Down.— Above chiefly chestnut, buff on sides of head with black streak behind the eye. Below grayish buff, palest on chin, browner on the sides. There is a dearth of specimens showing the transition into the next plumage.

Juvenal Plumage, acquired by a complete postjuvenal moult. Above dull brown, the feathers with white shaft-lines widening at the tip, the feathers of the nape and back with terminal black spots on the inner webs; crown dusky, gray laterally without shaft-lines, rump pale brown with faint whitish edgings. Wings and tail dull mouse gray with pale buff-mottled edgings on the primaries, whitish mottling on the rectrices; the secondaries and

their coverts a dull reddish brown indistinctly barred with buff bordered with dull black, the inner members black terminally edged with rich buff. Below dull gray on throat, breast and sides, the feathers with white shaft-streaks, the abdomen dull white and the chin clear white bordered posteriorly with the dusky tipped buff feathers of a throat band. Broad line below eye dull black, lores and superciliary stripe dull white or buff. Males are apt to be richer colored than are females and with grayer tails, whiter chins, blacker throat bands and often a slight dusky barring on the breast. A half dozen birds in my own collection show the change into first winter dress. No. 883, ♂, Connecticut, Oct. 22, and No. 2044, ♀, Connecticut, Oct. 5, have not yet entirely lost the natal down of the chin. They have recently lost the tenth and ninth primaries, the new ones of the winter dress being mere pin points. In neither of them have the two distal primaries pushed much beyond their follicles and in No. 2044 the third has barely reached its full development; otherwise they are in full juvenal dress. Nos. 2041, ♂, 2042, ♂, and 2043, ♀, Connecticut, Oct. 5, are further advanced, still having the white throats of the juvenal but with four primaries and a few body feathers of the winter dress. No. 6236, ♀?, New York, Oct. 21, and No. 6759, ♂, New York, Oct. 17, are still further advanced, the only remaining remiges of the juvenal dress being the second, third and fourth and the sixteenth to the twenty-fourth, together with the distal pair, as yet not fully grown. The winter plumage is coming in at the usual points on the body.

First Winter Plumage, acquired by a complete postjuvenal moult excepting the distal pairs of primaries of each wing. Young birds and old become practically indistinguishable although the young bird tends to less barring below and the white has a buff tinge, the colors above being duller with paler edgings. In the male the white juvenal chin is replaced by a purer white, in the female by a rich buff, the sexes now being distinctly differentiated for the first time. I have several specimens in my collection completing the postjuvenal moult. No. 860, ♀, Connecticut, Oct. 10, is in full winter body plumage, the first and second primaries show no evidences of growth, the third is old and the fourth a mere pin point, the fifth nearly grown and the rest of

the series new. They differ from the juvenal quills in being edged with pinkish buff; the rectrices, largely grown, are clear gray with little or none of the white mottling of the juvenal dress. No. 6262, ♀, New York, November 4, is at about the same stage of development, the tail and chin rather less advanced. It is hardly necessary to cite specifically other specimens, as the changes I have indicated are perfectly demonstrated by those already referred to by number.

First Nuptial Plumage.— This is evidently acquired by a very limited or incomplete prenuptial moult occurring in May. New feathers of the same color and pattern as the old grow upon the white chin, including its black border, and upon the sides of the head and the forehead. Birds taken at the right season to show this are extremely rare in collections, as it is contrary to law to shoot game birds out of season. There are three specimens, however (Amer. Mus. Nos. 25876, ♂, and 26493, ♀, Pennsylvania, May, and No. 55354, ♂, South Carolina, June 4), showing new growth, which is doubtless of regular occurrence.

Second or Adult Winter Plumage, acquired by a complete post-nuptial moult chiefly in September. A male in my collection, No. 2040, Connecticut, Oct. 5, is in nearly full winter plumage, the three outer primaries old and worn, the fourth only about one half grown, while the rectrices and some feathers of the chin are not yet fully developed.

Second or Adult Nuptial Plumage, acquired by a partial prenuptial moult, as in the young bird. It is hardly necessary to refer to this and later plumages, which are simply repetitions of each other, one for summer and one for winter. Wear is not an important factor and produces no appreciable effect upon the plumage, most of which is worn for an entire year.

Colinus virginianus floridanus (Coues). FLORIDA BOB-WHITE.

The plumages and moults are like those of *virginianus*, the prenuptial moult occurring somewhat earlier in the season. Most of the specimens I have seen are winter birds, taken not later than March, before the prenuptial moult would be expected to occur. However, a male from Nassau, Bahama Islands (Amer.

Mus. No. 35471, March 22) shows considerable renewal about the forehead, sides of head, chin, and jugulum, and several Florida birds in Mr. Sennett's collection show new growth in April and May.

***Colinus virginianus texanus* (Lawr.). TEXAN BOB-WHITE.**

The plumages and moults evidently correspond to those of *virginianus*. Two males taken at Corpus Christi, Texas (Amer. Mus. Nat. Hist., No. 55001, April 22, and No. 55002, April 24) both show new feathers growing about the chin and head and a number of specimens in the collection of Mr. George B. Sennett show a prenuptial moult, extending from March into May. The juvenal plumage is browner than in *virginianus*.

***Colinus ridgwayi* Brewster. MASKED BOB-WHITE.**

The material examined is not sufficient to enable me to reach any positive conclusions. The ruddy breast and black throat are evidently assumed at the postjuvenal moult.

***Oreortyx pictus* (Dougl.). MOUNTAIN PARTRIDGE.**

- “ “ ***plumiferus* (Gould).** PLUMED PARTRIDGE.
“ “ ***confinis* Anthony.** SAN PEDRO PARTRIDGE.

The material I have examined is limited but conclusive, showing the different stages occurring as follows:

Natal Down. — A broad stripe of rich chestnut runs from the forehead to the tail bordered on either side by narrow pale buff stripes, the sides and wings being mottled with dusky chestnut; a dark line behind the eye. Below uniform yellowish white, palest on the chin and buff on the sides of the head. A specimen of *pictus* in my collection (No. 4947, Oregon, May 27) has the middle members of the remiges just developing with the tuft of natal down at their apices. The distal pairs are not in view. Another bird representing *plumiferus* (No. 3897, ♀, Fresno County, California, August 4) is more advanced though still a mere chick and retaining natal down on head and throat.

Juvenal Plumage, acquired by a complete postnatal moult.

Above grayish brown with dark markings and dull white speckling, the neck and head clear gray with a little white speckling; crest dull brown with indistinct buff barring. Below gray with whitish edgings, chin chiefly white, the flanks and crissum chestnut tinged. Sexes practically alike. Two birds in my collection, No. 3895, ♂, Tacumba Valley, California, July 4, and No. 3896, ♀, San Gabriel Mts., California, Aug. 4, have assumed a few body feathers of the first winter dress. In neither are the two distal primaries fully developed while the postjuvénal moult has advanced from the tenth to the sixth. The rich brown feathers of the winter dress have begun to appear on the flanks, their origin being the sides of the breast.

First Winter Plumage. acquired by a complete postjuvénal moult, except the distal pairs of primaries. Birds become practically indistinguishable from adults and the females not very different from the males but with duller colors and smaller, browner crests.

First Nuptial Plumage.—The material examined does not show whether a prenuptial moult takes place or not. It probably does and is limited to the head as in the other Partridges.

Later plumages are but repetitions of the last two.

Callipepla squamata (Fig.). SCALED PARTRIDGE.

“ “ **castanogastris (Brewst.). CHESTNUT-BELLIED SCALED PARTRIDGE.**

I have examined about 150 specimens of these two forms, which show the plumages and moults at nearly all stages. Fading is more apparent than in any of the Quails.

Natal Down.—Several specimens have partly assumed the juvenal dress but the down of the head and throat indicates a juvenile dress mottled above and whitish below.

Juvenal Plumage, acquired by a complete postnatal moult. Above similar to *C. californica* but paler and more streaked, below grayer mottled with dull white. Numerous specimens show the change into the next plumage.

First Winter Plumage, acquired by a complete postjuvénal moult, excepting the two outer primaries, as is usual in this

family. Young and old become indistinguishable and males and females may now be told apart by the plumage for the first time.

First Nuptial Plumage, acquired by an incomplete prenuptial moult restricted to the head and throat, an occasional new feather showing elsewhere. There are a number of birds of both sexes with new feather growth apparent in April and May.

Second or Adult Winter Plumage, acquired by a complete post-nuptial moult which is well illustrated by specimens; a male from Arizona (Am. Mus. No. 56526, August 15) has renewed seven primaries and eight secondaries, together with half grown median rectrices, and much of the body plumage except part of breast, nape, head, throat and chin and some of the back and rump; two females from the same locality (Am. Mus. No. 56527, Aug. 26, and No. 56529, Sept. 6) are both less advanced, only the ninth and tenth primaries being new. Later plumages and moults are repetitions of earlier ones.

Callipepla californica (Shaw). CALIFORNIA PARTRIDGE.

“ “ *vallicola* Ridg. VALLEY PARTRIDGE.

The two forms of this bird are fairly represented by specimens I have examined.

Downy Plumage.—Above, rich brown, mottled on the sides with dusky brown; a dark line behind the eye. Below, dull white somewhat tinged with buff. The form *vallicola* is possibly grayer at this stage. The chicks are not very obviously different from those of *Oreortyx*.

* *Juvenal Plumage*, acquired by a complete postnatal moult. Above grayish brown with dusky and whitish edgings on the back and wing-coverts; nape gray with faint whitish shaft-streaks and dusky edgings. Below, gray with whitish edgings, producing a barred effect. A California bird (Amer. Mus. No. 61062, ♀, July 3) still retains the downy head, the first or distal primary is a mere pin feather, the second is half grown, the third and fourth show remains of their follicles, and the rest are grown except the inner members of the series. A female (Amer. Mus. No. 61063,

July 3) is much farther advanced, the chin being clothed, the under wing-coverts replacing the down, the dusky chestnut crest appearing, and the renewal of the remiges by the postjuvénal moult has involved the sixth to the fifteenth of the remiges.

First Winter Plumage, acquired by a complete postjuvénal moult, excepting the two distal primaries. Young birds are now scarcely distinguishable from adults, the colors, however, are not so deep.

First Nuptial Plumage, acquired by a partial prenuptial moult, limited to the fore parts of the head and throat. Several California specimens, male and female, illustrate this (Am. Mus. No. 61053, ♂, May 7, No. 61055, ♂, May 9, No. 61058, ♂, May 20, and No. 61059, ♀, May 23).

Later plumages are only repetitions of winter and summer dress.

Callipepla gambeli (Gambel). GAMBEL'S PARTRIDGE.

A fine series of about 150 specimens examined illustrates all the plumages and moults of this species.

Natal Down.—Very similar to *Callipepla californica*. Above, the crown is pale brown bordered by pale buff lateral stripes, the back nearly black and a dusky line behind the eye. Below, dull white, sides of head and an indistinct collar buff. A chick (Amer. Mus. No. 51426, Arizona, June 6) shows eight of the ten primaries just breaking from their follicles, most of the secondaries being at a similar stage of development.

Juvenal Plumage, acquired by a complete postnatal moult. Until the plumage of the nape appears the birds are almost indistinguishable from *Callipepla californica*. This region is then uniformly gray with more distinct shaft-streaks and no dusky borders as in *californica*. A number of specimens show different stages of this plumage. Two especially (Amer. Mus. No. 29619, ♂, Arizona, July 9, and No. 51413, ♀, July 12) show the juvenal plumage well advanced and the postjuvénal moult, beginning with the tenth primary before the first and second are nearly grown.

First Winter Plumage, acquired by a complete postjuvénal moult, excepting the two distal primaries. Young and old become

indistinguishable, males assuming the black throat and crest, females the browner dress. A male (Amer. Mus. No. 29637, Arizona, October 11) is acquiring a few black feathers of the chin patch and the chestnut feathers of the flanks, while the postjuvénal moult in the wing has reached the sixth primary, the two distal still retaining their follicles. A female (Amer. Mus. No. 29634, Arizona, October 9) is largely in first winter plumage, the only old feathers of the remiges being the third and the three proximal; a new blue-gray tail has replaced the mottled one of the juvenal plumage.

First Nuptial Plumage, acquired by a partial prenuptial moult limited to the anterior parts of the head and throat. Numerous specimens illustrate it. The black throat and its white border are renewed by feathers of the same color. The moult appears to take place in Arizona towards the end of April.

Second or Adult Winter Plumage, acquired by a complete post-nuptial moult.

Later plumages are like those already described.

Cyrtonyx montezumæ (Fig.). MASSENA PARTRIDGE.

A fine series of twenty-seven specimens illustrates well the different plumages, especially of the young bird.

Natal Down. — Above chestnut or rusty brown, in the median line, mottled with dull black and bordered with buff; a dusky line behind the eye. Below dull white, palest on the chin.

Juvenal Plumage, acquired by a complete postnatal moult. Both sexes now resemble the adult female, being streaked, but without the pinkish tint of the back and are black-spotted below with white shaft-streaks. A male (Amer. Mus. No. 58934, Arizona, September 12) still shows down on the throat and sides of the head. The juvenal rectrices are partly grown, the primaries are pulpy, the distal pair not yet visible, and the inner secondaries are still only partly developed. A female (Amer. Mus. No. 56536, Mexico, October 12) has assumed the dull white throat of the juvenal dress and shows the postjuvénal moult, which has already involved the seventh to the thirteenth of the remiges; the distal pair are not yet fully grown. Several other specimens show

the transition into first winter plumage (Amer. Mus. No. 29612, ♀, Arizona, Nov. 1; No. 56538, ♂, Mexico, Sept. 19, and others).

First Winter Plumage, acquired by a complete postjuvinal moult excepting the two distal primaries.

One male is in nearly full plumage (Amer. Mus. No. 35225, Arizona, November 20), the first and second primaries full grown, the third one half and the remainder of the series new except one or two of the proximal secondaries. Males assume the rich and beautiful plumage of the adult, now first being distinctly differentiated from the females which are streaked and spotted and decidedly pinkish.

First Nuptial Plumage.—There is a limited prenuptial moult as shown by specimens in Mr. Geo. B. Sennett's series.

Subsequent plumages are only repetitions of those already described.

(To be concluded.)

REPORT OF THE A. O. U. COMMITTEE ON PROTECTION OF NORTH AMERICAN BIRDS.

THE YEAR just passed has been a most important one to those interested in the furthering of bird protection, particularly to the members of your Committee.

During the years 1896 and 1897, largely through the personal efforts of Mr. Wm. Dutcher, then chairman of this Committee, the cause of bird protection was brought prominently before women's clubs and similar organizations in all parts of the country, with a view to arousing a general interest in the subject and bringing it to the attention of the general public. The success which attended these efforts was shown in Mr. Dutcher's reports and in the voluminous correspondence of your Committee during the year covered by our last report. Audubon Societies, organized for bird protection and the encouragement of bird study, have sprung up on every hand, and nearly every